



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

REVIEWS

The Illinois Glacial Lobe. By FRANK LEVERETT, Monograph XXXVIII, U. S. Geological Survey, pp. 817. Plates XXIV, 9 figures. Washington, 1899.

This is one of a series of monographs in course of preparation by the Glacial Division of the United States Geological Survey, whose purpose is to set forth the salient features of the glacial formations preparatory to more detailed mapping by quadrangles, which the survey is undertaking, and by counties and other appropriate divisions, which many of the states are prosecuting. In a sense it may be said to be the first monograph of the systematic series. Two other monographs have been published, namely, that on Lake Agassiz, by Mr. Warren Upham, and that on the Glacial Gravels of Maine, by Professor George H. Stone, but these are special treatises on phenomena of exceptional interest and only indirectly form a part of the systematic series intended to cover the glacial area. The plan of the Survey departs somewhat widely from that prevalent in Europe where glacial work proceeds largely by minute studies of small areas without previous determination of the great features and broader classifications which can only be worked out by connected studies over large areas. The method of the United States Geological Survey has been to determine first these grand features and leading classifications and then descend in natural order to local details and more refined studies. Local mapping proceeds at great disadvantage without such preliminary determinations, for such is the nature of the glacial formations that these larger expressions of the phenomena of the period are very imperfectly expressed within any restricted area, and are quite beyond satisfactory interpretation unless the studies are extended beyond them.

The general reconnaissance work of the survey was essentially completed some years ago by the geologist in charge and the work of preparation of the monographs, as the second step of the plan, is now well under way. Besides the monograph under consideration, the manuscript of an additional one has been submitted and work upon a third is in progress.

The products of the Illinois glacial lobe constitute a natural monographic theme, for the differentiation of the border tract of the ice by the topographic influences of the trough of Lake Michigan gave the lobe a quite distinct individuality. In the monograph, however, for convenience the field is rather arbitrarily limited on the north where the products of the Illinois lobe become complicated on the east side with those of the Huron-Erie and the Saginaw lobes and on the west side with those of the Green Bay lobe. This limitation, however, does not seriously affect the unity of the theme. This lobe was given precedence because its field embraces the most southerly reach of the great ice mantle and because its products are unusually well deployed.

The author's abstract of the monograph which follows, sets forth its contents better than could be done by another.

Chapter I. Introduction.—The Illinois glacial lobe formed the southwestern part of the great ice field that extended from the high lands east and south of Hudson Bay southwestward over the basins of the Great Lakes and the north-central states as far as the Mississippi valley. It overlapped a previously glaciated region on the southwest, whose drift was derived from an ice field that moved southward from the central portion of the Dominion of Canada as far as the vicinity of the Missouri River. This southwestern part of the eastern ice field, being mainly within the limits of the State of Illinois, has received the name Illinois Glacial Lobe.

The results of earlier studies by Chamberlin, Salisbury, and others are noted, and the plan of investigation is set forth. A brief explanation of the method of numbering townships is presented.

Chapter II. Physical features.—The variations in altitude are set forth in a topographic map and also in tables, and the marked increase in altitude of certain parts of the region because of drift accumulations is considered. The conspicuous reliefs of the rock surface are briefly touched upon, and the preglacial valleys receive passing notice. Profiles and maps are extended across the bed of Lake Michigan as well as border districts, and the inequalities of the lake basin are briefly discussed.

Chapter III. Outline of time relations or glacial succession.—A sketch of the major and minor divisions of the drift sheets and of the intervals between them is accompanied by a brief explanation of the basis for the classification adopted.

Chapter IV. The Illinoian drift sheet and its relations.—The Illinoian is the most extensive drift sheet formed by the Illinois glacial lobe and receives its name because of its wide exposure in the State of Illinois. The evidence that the Illinoian drift sheet should be separated from the outlying and underlying drift is briefly set forth. The aspects of the Illinoian drift

sheet are then discussed, its topography as well as its structure being considered. In connection with this drift sheet a very adhesive clay known as "gumbo," which caps it, is described and the questions of its relation to this drift sheet and to the overlying loess are considered. A detailed description of the border of the Illinoian drift sheet is then given, which is followed by a description of the moraines and other drift aggregations back from the border.

Remarkable instances of the transportation of rock ledges are noted. The striae pertaining to this invasion are discussed in some detail. The effect of this ice invasion and its drift deposits upon the outer-border drainage is touched upon, but the detailed discussion of the influence of the drift upon drainage is deferred to a later chapter. The chapter closes with a discussion of the deposits which underlie the Illinoian drift sheet.

Chapter V. The Yarmouth soil and weathered zone.—A well-defined soil and weathered zone which appear between the Kansan and Illinoian drift sheets in the overlap of the latter upon the former are described, and sections are represented which show clearly the relations to these drift sheets. The amount of erosion effected during the interglacial stage is also considered. The name Yarmouth is taken from a village in southeastern Iowa, where the interglacial features were first recognized by the writer.

Chapter VI. The Sangamon soil and weathered zone.—Another well-defined soil and accompanying weathered zone which appear between the Illinoian drift and the overlying loess are described. The name Sangamon is applied because these features are exceptionally well developed in the Sangamon River basin in Illinois and were there first noted by Worthen in the early reports of the Illinois Geological Survey.

Chapter VII. The Iowan drift sheet and associated deposits.—The name Iowan was applied by Chamberlin to a sheet which is well displayed in eastern Iowa and which had been brought to notice by McGee. The chapter opens with the discussion of a drift sheet of a similar age which was formed by the Illinois lobe, its extent, topographic expression, and structure being considered. The relation of this ice lobe to the Iowa ice lobe, and the relation of each to the great loess deposit of the Mississippi basin are then considered, after which the loess is discussed. The problem of the mode of deposition of the loess forms the closing topic.

Chapter VIII. The Peorian soil and weathered zone (Toronto formation). The name Toronto formation, suggested by Chamberlin, for interglacial deposits exposed in the vicinity of Toronto, Canada, may prove to be applicable to a soil and weathered zone which appear between the Iowan drift sheet or its associated loess and the Shelbyville or earliest Wisconsin drift sheet which overlies the Iowan. Exceptionally good exposures of a soil and weathered zone at this horizon in the vicinity of Peoria, Ill., make it seem

advisable to apply the name Peorian, while the relations of the Toronto formation remain uncertain. Other exposures as well as those near Peoria are discussed. A marked interglacial interval between the Iowan and Wisconsin stages of glaciation may also be inferred by a comparison of the outline of the ice sheet at the Iowan stage of glaciation with that of the outline at the culmination of the Wisconsin stage. It may also be inferred by a change in the attitude of the land, by which better drainage conditions were prevalent in the Wisconsin than in the Iowan stage.

Chapter IX. The early Wisconsin drift sheets.—The Wisconsin drift, named by Chamberlin from the state in which it was first recognized as a distinct drift, is characterized by large morainic ridges and comparatively smooth intervening till plains which have been thrown into two groups, known as the early Wisconsin and late Wisconsin. In the first group the moraines form a rudely concentric series, which are well displayed in the northeastern part of Illinois, but are largely overridden by the moraines and drift sheets of the later group in districts farther east. The outer border of the second, or late, Wisconsin group is so discordant with the moraines of the first group that there seems in this feature alone sufficient reason for separation.

The several morainic systems of the early Wisconsin group are taken up in succession from earlier to later, the distribution, relief, range in altitude, surface contours, thickness and structure of the drift, and the character of the outwash being considered. In connection with each morainic system the associated till plains are discussed, attention being given to the surface features and to the structure and thickness of the drift. In northern Illinois the several morainic systems are merged into a composite belt so complex that it is difficult to trace the individual members.

The several moraines and their associated sheets of till do not appear to be separated by intervals so wide as are found between the Illinoian and Iowan or the Iowan and Wisconsin drift sheets. Indeed, instances of the occurrence of a soil or a weathered zone between Wisconsin sheets are very rare. There may, however, have been considerable oscillation of the ice margin.

Chapter X. The late Wisconsin drift sheets.—The basis for separation from the early Wisconsin is first considered, after which the several morainic systems and their associated till plains are taken up in order as in the discussion of the early Wisconsin drift. An interpretation of the Kankakee sand area is attempted, though several questions connected with it still remain open. The chapter closes with a discussion of the striæ found within the limits both of the early and of the late Wisconsin drift.

Chapter XI. The Chicago outlet and beaches of Lake Chicago.—That a body of water once extended over the low districts bordering the southern end of Lake Michigan and discharged southwestward to the Des Plaines and thence into the Illinois River has been recognized since the early days of

settlement, and several papers discussing the beaches and the outlet have appeared. The latter has long been known as the Chicago outlet, because it led away from the site of that city. The lake has recently been given a name in harmony with that of the outlet (Lake Chicago).

After reviewing the previous reports and papers, the Chicago outlet is described in some detail. The several beaches of Lake Chicago are then taken up in order from highest to lowest. The chapter ends with a discussion of the present beach of Lake Michigan.

Chapter XII. Influence of the drift on drainage systems and drainage conditions.—It is shown that many drainage systems are entirely independent of the preglacial lines, while others are independent only in part, a considerable part of their courses being along the lines of old valleys. The development of drainage systems is shown to be much farther advanced on the Iowan and Illinoian drift sheets than on the Wisconsin. This is found to be due to differences in age, and not to natural advantages for discharge. The Wisconsin is, on the whole, more favored by uneven surface for the rapid development of drainage lines than the Illinoian. The several drainage systems are discussed in considerable detail.

Chapter XIII. Average thickness of the drift in Illinois.—Illinois affords an especially good opportunity for the estimate of the thickness of the drift, because of the large number of well sections obtained, and because of the comparative smoothness of the region. The inequalities of the rock surface beneath drift plains may be estimated by the study of neighboring driftless tracts, as well as by borings and outcrops within the drift-covered area. There are thus two quite different methods by which the average thickness of the drift may be ascertained.

The first method here used is that of averaging the results of borings and outcrops. These are averaged in each township in which the distance to rock is known, and the results are then combined for the average of all the explored townships. Consideration is then given to the distribution of the explored townships in reference to drift plains and moraines and to preglacial uplands and valleys, and necessary corrections are made. By this method the thickness of the drift is found to be not less than 100 feet, and it may be 120 feet or even more.

The second method, based upon a comparison of the Illinois drift area with the neighboring driftless tracts, gives 129.3 feet as the average thickness, or slightly more than the highest results obtained by the first method. Combining the two methods, the average thickness of the drift of Illinois can be placed at not more than 130 feet and not less than 100 feet.

An attempt is made to estimate the part contributed by each ice invasion, but the data prove to be scarcely complete enough for a good estimate. It is found that the general thickness within the limits of the Wisconsin drift is 40 to 45 feet greater than in the portion of the state outside.

Chapter XIV. The wells of Illinois.—This chapter aims to present all the reliable well records obtained within the state which throw light upon the deposits penetrated, as well as upon the character of the water supplies. In addition to the wells which terminate in the drift, there are included many which extend deeply into the underlying rock formations. This necessitates a classification of the underground waters and a description of the several rock formations penetrated, including a discussion of the attitude of the strata. The essential conditions for obtaining artesian wells are considered, and also the relation of the drift to the ordinary wells. There is a brief discussion of gas wells, confined mainly to those obtained in the drift. A tabulation of sources for city water supply is then presented, after which there appears a detailed discussion of wells, taken up by counties.

Chapter XV. Soils.—The sources of soil material are first discussed. An attempt is then made to classify the soils according to their origin. Eight classes are recognized as follows: Residuary soils, bowlder clays, soils, gravelly soils, sandy soils, bluff-loess soils, silts slowly pervious to water, fine silts nearly impervious, peaty or organic soils.

The matters of chief general interest will doubtless be found in the classification of the glacial series, in the changing configuration of the ice at its successive stages, in the differences of the deposits at the different stages, and in the estimate of the average thickness of the drift.

In the matter of classification, the monograph presents the latest and fullest expression of the conclusions toward which investigations in the interior have been steadily tending for the past decade. The classification offered is not regarded as final, either in the sense of including all the possible great divisions, or in the complete characterization of those recognized, but it clearly lies in the line of a true and ultimate classification. Fifteen stages are recognized, six of which are based upon notable glacial advances, five represent notable intervals of deglaciation, and four are based upon lacustrine stages after the beginning of the abandonment of the region by the last ice-sheet. The age of the oldest glacial formation is regarded as many times that of the latest; and the oldest interglacial intervals are also believed to be many times longer than the later ones. In a word, the oscillations appear to have been large in the earlier stages and to have grown less and less during the progress of the period. This newer view of the relative ages of the successive epochs, sustained as it appears to be by the progress of research in Europe, must be looked upon as one of the most important advances of recent years, for

it affects profoundly nearly all of the larger questions of glacial history.

The distinction between the ages of the several glacial sheets is founded upon careful estimates of the amounts of erosion they have respectively suffered, upon the depths and extent of the weathering process as exhibited alike in the clays and in the pebbles and boulders, upon the degree of constructive mineralization in the form of segregates and general induration of the deposits, upon the extent of interglacial accumulations of soil, peat and similar deposits, and upon the nature of the life which occupied the region between the glacial stages, together with incidental criteria of more special nature and limited application. When it is considered that the broad sheet of Kansan till, which shows indubitable evidence of having been spread out as an approximately plane sheet, has been so thoroughly eroded over very large areas that only remnants of the original plane remain here and there, it is impossible for the candid mind to resist the conviction that it is very widely separated in age from the later drift-sheets which have been merely ditched by the water courses, leaving scattered over the broad, scarcely modified surfaces, multitudes of shallow basins which a few feet of cutting would completely drain.

While not new, the monograph brings out into sharp definition the lobate character of the ice margin at all of its stages. At the same time it shows that there was a change in the configuration of these lobes at different stages. It is perfectly clear from the general nature of these configurations that they are fundamentally dependent upon the topography of the region they occupy and of that which lies backward along the line of glacial invasion. At the same time there are some anomalies which, while not defiant of topography, do not clearly show their dependence upon it and indicate that other factors than topography were involved in determining the development of the ice lobes. These other agencies are very likely climatic, but they have not yet been deciphered. The most notable of these anomalies are the peculiar forms assumed by the Iowan drift and the shifting in the contours of the lobes between the earlier and later Wisconsin stages.

Closely allied to this variation in configuration is a remarkable variation in the mode of action of the ice at different stages to which the monograph contributes a large mass of data. The earlier drift-sheets

are spread widely over the country without evidences of profound abrasive action upon the pre-existing surface, not that such action was absent, but it was far less vigorous than in the later stages. In harmony with this milder action upon the face of the country invaded, the drift-sheet itself was spread much more uniformly than in later times and pronounced morainic ridges are much more rare, and when present are much feebler and less characteristic. At the same time, the glacial drainage appears to have been much less vigorous and in some instances surprisingly lacking in vigor. These phenomena are among the most suggestive that yet await causal explanation.

By far the most careful and trustworthy estimate of the average thickness of the drift which has heretofore been made in this country is embraced in chapter XIII of this monograph. Not only are the data much more ample and better distributed than those that have heretofore been at command, but they have been analytically classified and discussed by more critical methods. The most difficult element of the problem is the drift embraced in the preglacial valleys, the depth and configuration of which it is difficult to estimate. This has been attempted, however, along two different lines which give essential concordant results, and it is a fair presumption that the total estimate of the mass of the drift of the region investigated is a not distant approximation to the real facts. How far the territory of the Illinois glacial lobe is representative of the average thickness of the drift throughout the glaciated region cannot now be determined, for if the great Canadian tract be embraced, as it should, our knowledge is best defined by emphasizing its limitations; but the average thickness in Illinois may rudely represent the average thickness for areas similarly situated near the border of the glaciated area, but even this cannot be confidently affirmed.

The work of Mr. Leverett is conspicuous for the judicial attitude of mind which eminently controls it. The emotional factor is held in marked abeyance and the intellectual factor suffers little trammeling from predilections. At the same time the large area covered by critical study testifies to an industry which could not have been greatly enhanced by emotional enthusiasm. The monograph will be best appreciated by those who are most familiar with the ground.—T. C. C.